Polygons for River FLWs/FLSs

Jeff Zogg, Senior Service Hydrologist
National Weather Service WFO Des Moines, Iowa

Rick Sloan, Service Hydrologist
National Weather Service WFO Dodge City, Kansas

Mike Callahan, Senior Service Hydrologist
National Weather Service WFO Louisville, Kentucky

Updated February 19, 2014

Table of Contents

Figures

Tables

1. Acknowledgments

The authors would like to thank the many people who have tested and installed these river FLW polygons. Valuable suggestions have been provided which have helped the installation procedure and have even yielded alternative methods for installation. The time and insights they provided to help enhance the delivery of NWS flood-related services are greatly appreciated.

2. Introduction

2.a. Background

Normally NWS WFOs use RiverPro to issue river Flood Warnings (FLWs) and subsequent river Flood Statements (FLSs) for river forecast points on rivers and streams. By default the related RiverPro river FLW/FLS templates include only the county codes for the areas affected by a given river FLW. The river FLWs are then highlighted on the NWS watch, warning and advisory (WWA) maps by shading all the counties included in the river FLWs.

Typically the actual area affected by river FLWs is significantly less in geographic size than what is indicated on the WWA map. WFO Des Moines, Iowa developed a method that allows RiverPro to provide latitude and longitude coordinates of the areas affected by a given river FLW. The WWA maps then indicate the river FLW by shaded river FLW polygons rather than by shaded counties. A positive result is less shading on the WWA map—the affected areas are more specifically identified. See Figure 1 for examples of the river FLW polygons on the local WFO WWA maps. Figure 2 provides an example of the river FLW polygon information included in the actual text of a river FLW segment for a river forecast point.

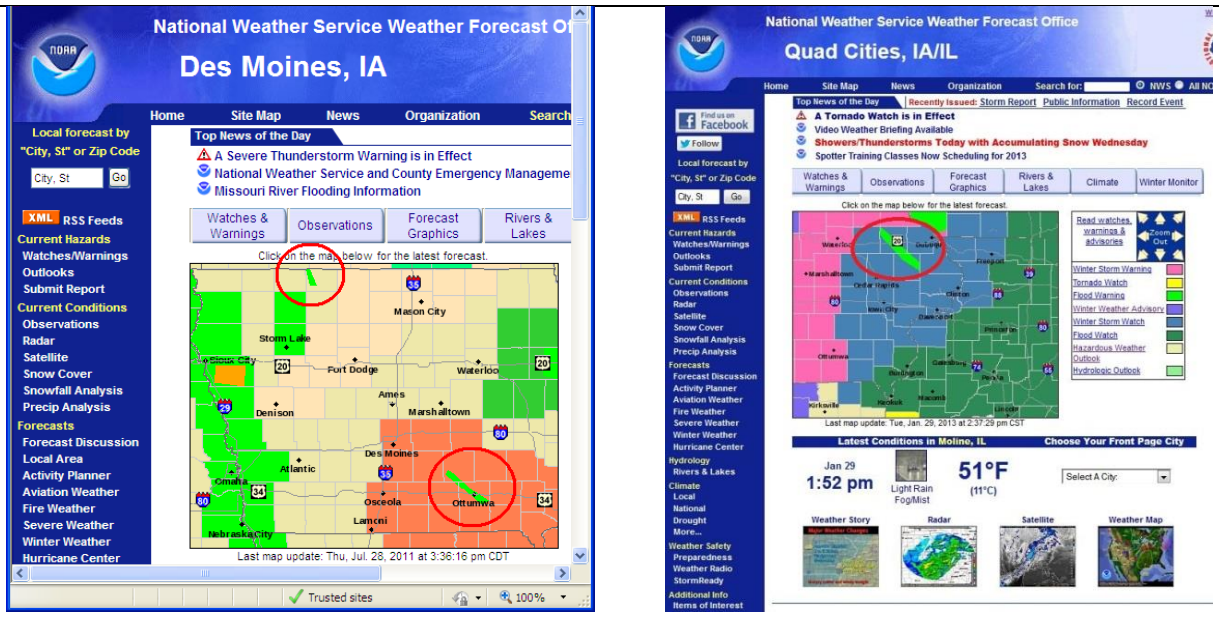

Figure 1. Examples of the river FLW polygons on the WFO WWA maps. The river FLW polygons are located within the red ovals. Image on the left provided by Mark Glaudemans (WHFS Support). Image on the right provided by Maren Stoflet (Service Hydrologist, WFO Quad Cities, Iowa/Illinois).

```
IAC123-179-221522-
/O.NEW.KDMX.FL.W.0094.110721T1522Z-000000T0000Z/
/EDYI4.1.ER.000000T0000Z.110721T1030Z.000000T0000Z.NO/
1022 AM CDT THU JUL 21 2011

...FLOOD WARNING IN EFFECT UNTIL FURTHER NOTICE...

THE NATIONAL WEATHER SERVICE IN DES MOINES HAS ISSUED A
* FLOOD WARNING FOR
  THE DES MOINES RIVER NEAR EDDYVILLE...OR FROM CEDAR CREEK NEAR
  TRACY...TO MIDDLE AVERY CREEK NEAR CHILLICOTHE.
* UNTIL FURTHER NOTICE.
* AT  9:00 AM THURSDAY THE STAGE WAS 61.2 FEET.
* FLOOD STAGE IS 61.0 FEET.
* MINOR FLOODING IS OCCURRING AND IS FORECAST TO CONTINUE.
* FORECAST...REMAIN NEARLY STEADY AROUND 61.2 FEET FOR THE
  NEXT SEVERAL DAYS.
* IMPACT...AT 61 FEET WATER BEGINS IMPACTING MAIN STREET IN
  EDDYVILLE.

&&

LAT...LON 4111 9251 4124 9269 4129 9280 4124 9283 4108 9258
```

```
$$
```

Figure 2. Example of river FLW polygon information included in a river FLW segment (highlighted in yellow) for a river forecast point.

The river FLW polygon information is provided in addition to the county coding. The NWS Directives (i.e., NWSI 10-922) require the inclusion of county coding. The inclusion of river FLW polygon information is also allowable—as supplemental information—per NWSI 10-922.

This document first describes the method used at WFO Des Moines to use river FLW polygons in AWIPS. Alternative methods are described after the description for the WFO Des Moines method. One of these alternative methods may work better for your office than does the WFO Des Moines method. A summary of advantages and disadvantages for all methods—including the alternative methods—is provided in Table 1 in Section 9.

2.b. River FLW Polygon Recommendations and Requirements

Ideally the river FLW polygons will coincide with the reaches defined for each river forecast point. If there are small gaps between the reaches of subsequent river forecast points then it may be advisable to extend each river FLW polygon such that a continuous river FLW polygon exists if the entire river is in flood. This practice may not be feasible if significant gaps exist between the river reaches for river forecast points. According to NWSI 10-950 (Definitions and General Terminology) a river reach is defined as:

> A section of river or stream between an upstream and downstream location, for which the stage or flow measured at a point somewhere along the section (e.g., gaging station or river forecast point) is representative of conditions in that section of river or stream.

Factors which should be considered when defining a reach include but are not limited to:

- Backwater impacts.
- Change in river elevation (i.e., fall of the river).
- Upstream and downstream dams.
- Confluence of rivers.
- Potential inflows of streams which would impact downstream locations using the given river forecast point.
- Changes in the river channel from a more confined to a broader flood plain.

A river reach is unique to each location. Although the determination of the extent of the reach may involve some subjectivity, the above factors should be considered.

It is also recommended that the river FLW polygons be wider than the actual area impacted. This practice allows for the river FLW polygons to be more visible on the WWA maps. If the river FLW polygons are too narrow then they may be difficult to see on the WWA maps. At WFO Des Moines the river FLW polygon widths were generally no less than 5 to 10 miles wide—to make sure they were visible on the WWA maps. In other words the river FLW polygons were not drawn to approximate the inundation.

The recommended precision for the latitude and longitude for each river FLW polygon coordinate is two decimal places. The approach used at WFO Des Moines utilizes such precision.

It is important that the latitude/longitude pairs are listed in subsequent (i.e., plotting) order. In addition the last latitude/longitude pair does not need to be the same as the first one. The latitude/longitude pairs should also be listed in a clockwise direction around the river FLW polygon. In other words the vertices should be listed in plotting order because the WWA map software will plot the river FLW polygon in a "connect the dots" fashion. After plotting the last latitude/longitude pair the WWA map software will simply draw a line from it to the first latitude/longitude pair to close the river FLW polygon.

3. WFO Des Moines Method Description

The procedure involved in including river FLW polygons in RiverPro includes the following three major steps. Each step will be described in this document.

1. Define the river FLW polygons.
2. Import the river FLW polygon definition data into AWIPS.
3. Modify the RiverPro crest comparison template as well as the RiverPro product definition files to include the river FLW polygon information.

The WHFS template variable `<LocGeoArea>` is used to store the river FLW polygon information for each river forecast point. The `<LocGeoArea>` variable points to the field named `area` in the WHFS hydro Postgres database table named `locarea`. WFO Des Moines was not using the `<LocGeoArea>` variable to store any information.

Note: the `<LocGeoArea>` variable has a length limit of 80 characters. This limitation has not proven to be an issue thus far.

The following method to define river FLW polygons for AWIPS assumes knowledge and comfort with the following items.

- Microsoft Excel spreadsheets

- Use of the Linux terminal windows to enter and execute Linux commands
- Postgres and Postgres commands

4. WFO Des Moines Method Step #1—Define the River FLW Polygons

4.a. How to Do It

First you must define the river FLW polygons to be used for each river forecast point. Various tools can be used to help define and modify the river FLW polygons. At WFO Des Moines, Google Earth is utilized to help define them. Many other tools—including Web-based tools—exist.

4.b. Method-Specific River FLW Polygon Recommendations and Requirements

The present limitations of RiverPro and associated line wrap in the river FLW/FLS text products result in **a limit of no more than five latitude/longitude pairs used for each river FLW polygon. No more than five latitude/longitude pairs can be used for any particular river FLW polygon.** If any given river FLW polygon has more than five latitude/longitude pairs then word wrap functionality may yield unpredictable results in the WWA maps.

4.c. Microsoft Excel Spreadsheet

At WFO Des Moines the office StormData staff already had defined river FLW polygons for river forecast points. These points were stored in a Microsoft Excel spreadsheet which has been included in a separate file with this documentation. They are included in the spreadsheet tab named `Data` .

Note: some of the river forecast points utilized more than five latitude/longitude pairs. Due to the aforementioned limitations each river forecast point must have no more than five pairs. The WFO Des Moines StormData staff utilized Google Earth to help redefine those river FLW polygons as needed. The result is in the spreadsheet tab named `NoMoreThan5` .

5. WFO Des Moines Method Step #2—Import the River FLW Polygon Definition Data into AWIPS

5.a. Modify the River FLW Polygon Data for Compatibility with the WHFS Postgres Database

Before the river FLW polygon definition data are imported into AWIPS the data must be

converted to a format that is compatible with the WHFS hydro Postgres database.

First the data is converted in the Excel spreadsheet. In the tab named `NoMoreThan5` the formulas (in blue text color) are located to the right of the river FLW polygon definitions. The formulas eventually produce a string that includes all of the latitude/longitude pairs for a given river forecast point. This information is in Column AN. Column AO lists the character length of each string. No string can have a length of more than 80 characters. This restriction exists due to the length limitation of the WHFS hydro Postgres database field used to store the river FLW polygon information. If no more than five latitude/longitude pairs are used then the string will likely be considerably less than 80 characters long.

Second the data from Columns B and AN in the tab named `NoMoreThan5` are copied to Columns A and B in the tab named `ExportToAWIPS` . The data in the tab named `ExportToAWIPS` will be eventually copied into the WHFS Postgres database.

The final step in the spreadsheet is to save the data in the tab named `ExportToAWIPS` in comma-separated values (CSV) format. Do a `Save As` in Excel to do this. Although you can name the file whatever you want you must remember its name. WFO Des Moines uses the file named `polys_dmx.csv` .

5.b. Move the River FLW Polygon Data to AWIPS

Once the file is saved in CSV format copy it to AWIPS. You may need assistance from your office's ITO or ESA in copying the file to AWIPS.

Once you copy the file to AWIPS it is recommended that you strip any Windows/DOS related characters from the file by using the dos2unix utility. In a Linux terminal window type:

```
dos2unix filename
```

where `filename` is the name of the file containing the river FLW polygon latitude/longitude data.

5.c. Import the River FLW Polygon Data into the WHFS Postgres Database

<u>Warning:</u> the following instructions use Postgres commands to modify your local WHFS Postgres database. Significant, irreparable damage may occur to the WHFS hydro database if the below instructions are not followed properly. Only people who have experience with Postgres and the WHFS Postgres database should execute the following instructions.

Open a Linux terminal window and go to the subdirectory where your river FLW polygon data file is located. Then start Postgres via the command line. At WFO Des Moines the following command is used:

```
/usr/bin/psql hd_ob92dmx
```

The 92 refers to the latest version of the WHFS database and dmx refers to the AWIPS site ID for WFO Des Moines. You will likely need to use different values locally.

Once you are in Postgres you must create a temporary table to hold the river FLW polygon latitude/longitude data, import the data from the file into the temporary table and then import that data into the permanent WHFS Postgres database. Figure 3 shows the Postgres commands used at WFO Des Moines to upload the river FLW polygon data for all river forecast points simultaneously.

```
create temporary table tmp_polys_dmx (
nwsli varchar(8),
poly_coords varchar(80)
);

\copy tmp_polys_dmx from 'polys_dmx.csv' with delimiter ','

update locarea set area=poly_coords from tmp_polys_dmx where
(lid=nwsli and nwsli in (select lid from location where hsa='DMX') );
```

Figure 3. Postgres commands used at WFO Des Moines to upload the river FLW polygon data for all river forecast points simultaneously.

In Figure 3 note the use of the filename polys_dmx.csv as well as the name of the temporary Postgres table named tmp_polys_dmx. The file polys_dmx.csv contains the river FLW polygon data. On the last line DMX refers to the AWIPS site ID for WFO Des Moines.

After attempting to import the data you should verify that it was imported successfully. As stated earlier the river FLW polygon data is stored in the field named area in the WHFS hydro Postgres database table named locarea. You can use various tools to view the data in this field such as Postgres or Snoopy. An alternative way is to view the data in HydroBase. In the HydroBase main menu select RiverGage – Description and then look in the section named Affected Area.

5.d. Important Note

Before river FLW polygon data is written to the database for a particular river forecast point the Postgres database must be ready to accept it. Normally if information already exists for a river forecast point in the window accessed in the HydroBase main menu by RiverGage – Description then the Postgres database should be ready to accept the river FLW polygon data. If no data exists in that window then for each river forecast point you wish to provide river FLW polygon information, go into the window accessed in HydroBase by RiverGage – Description. First click on the Save button located below the Affected Area section (i.e.,

not the one located below the `Topography` section). Then click on the `Exit` button at the bottom of the `Description` window to return to the HydroBase main window.

If the Postgres database was not ready to accept the river FLW polygon data for a particular river forecast point then it will not upload it to the database for that particular river forecast point when you try importing the data. No harm will be done to the Postgres database if this happens.

Once the river FLW polygon data has been successfully imported into Postgres you are ready to modify the river FLW polygon information.

6. WFO Des Moines Method Step #3—Modify the RiverPro Crest Comparison Template as well as the RiverPro Product Definition Files to Include the River FLW Polygon Information

<u>Warning:</u> the following instructions result in modification of important RiverPro configuration files. If the below instructions are not followed properly then significant, irreparable damage may occur to your RiverPro configuration files. Only people who have experience with editing RiverPro configuration files should execute the following instructions. It is recommended that you make backup copies of the below named RiverPro configuration files before modifying them.

6.a. How to Do It

A rather simple modification is needed to the RiverPro river FLW/FLS templates to include the river FLW polygon information. Keep in mind the following important points for modifying the templates.

- You will have to add a section for the river FLW polygon delineation to the RiverPro crest comparison template named `compare.tpl.XXX` (where `XXX` is the AWIPS site identifier for your office). The crest comparison template—as well as the other RiverPro templates—is located in AWIPS at `/awips/hydroapps/whfs/local/data/app/riverpro`.
- You will also have to modify each RiverPro product definition file(s) (i.e., PCC file) for which you want the river FLW polygon information inserted. At WFO Des Moines the river FLW polygon information is provided for all RiverPro-generated river FLWs/FLSs.
- The river FLW polygon information is included as supplemental information for each river FLW/FLS river forecast point segment. In other words the information follows the bulleted information and is separated by the double ampersands (i.e., `&&`).

6.b. Crest Comparison Template

Insert the text in Figure 4 into the RiverPro crest comparison template named

compare.tpl.XXX. If you already include supplemental information for each river forecast point then you will need to merge that information with the river FLW polygon information.

```
#
name:lat_lon
varlist:<LocGeoArea>
#
#  LATITUDE/LONGITUDE INFO FOR river FLW polygonS
#
phrasestr:||&&|| ||LAT...LON <LocGeoArea>
#
```

Figure 4. Text to insert into compare.tpl.XXX.

6.c. RiverPro PCC Files

Next modify each RiverPro PCC file(s) for which you want the river FLW polygon information inserted. Typical examples include but are not limited to the PCC files associated with river FLWs/FLSs.

In the Product Section of the PCC file be sure the two lines in Figure 5 are included:

```
INCLUDE_SECTIONS:  HEADER, HEADLINE, BASIS, CALL_TO_ACTION,
POINT_SPECIFIC

INCLUDE_SUBSECTIONS:  DATA_ROUNDUP, IMPACT_STATEMENT,
HISTORICAL_COMPARISON
```

Figure 5. Lines to include in the Product section of the PCC file.

Although the lists in your office's PCC files may not include all the elements in Figure 5 it is important that:

- In the INCLUDE_SECTIONS line the POINT_SPECIFIC element must be listed last.
- In the INCLUDE_SUBSECTIONS line the HISTORICAL_COMPARISON element must be listed last.

You must also make sure that the Crest Comparison section of the PCC file (i.e., typically near the bottom of the file) is shown in Figure 6.

```
#-------------------------------------
#     CREST COMPARISON SECTION
#
SUBSECTION: HISTORICAL_COMPARISON
TEMPLATE: LAT_LON
SEARCH_TYPE: CLOSEST_IN_WINDOWS
REFERENCE_VALUE_TYPE: MAX
STAGE_WINDOW:    -5.00     5.00
FLDSTAGE_FILTER:   -10.00
FLOW_LOWER_WINDOW:     10.00
FLOW_UPPER_WINDOW:     10.00
FLDFLOW_OFFSET_FILTER:     10.00
TIME_WINDOW: 50
ENDSUBSECTION:
#-------------------------------------
```

Figure 6. Definition of the `Crest Comparison` section of the PCC file.

Note: the template name you specify in this section—in this case `LAT_LON` —must match the name you specified in the crest comparison template file earlier.

7. Alternative Method by WFO Dodge City & WFO Louisville

This alternative method was suggested by Rick Sloan (Service Hydrologist at WFO Dodge City, Kansas) and Mike Callahan (Senior Service Hydrologist at WFO Louisville, Kentucky). This method may be desirable if you do not have river FLW polygons defined for all of your river forecast points but still wish to immediately begin utilizing the river FLW polygon capability in RiverPro and not wait until all of your river FLW polygons are defined. The advantages of this method are:

- No direct interaction with Postgres is required. You only have to work directly with RiverPro template files and HydroBase.
- If river FLW polygons are not yet defined for all of your river forecast points then this method will allow RiverPro to output the river FLW polygon information only for those river forecast points where they are defined—without the need for separate river FLW polygon and no river FLW polygon RiverPro templates.
- This method will allow RiverPro to use the river FLW polygon definitions which you already have. It will be able to use river FLW polygon definitions you subsequently add with minimal additional configuration work.

7.a. HydroBase Changes

7.a.1. Five Point vs. Six Point River FLW Polygon

A five point river FLW polygon will yield a pentagon which may work in many cases. A six point river FLW polygon can look like a bent box which can work well with several points along a mainline river. See Figure 7 for an example.

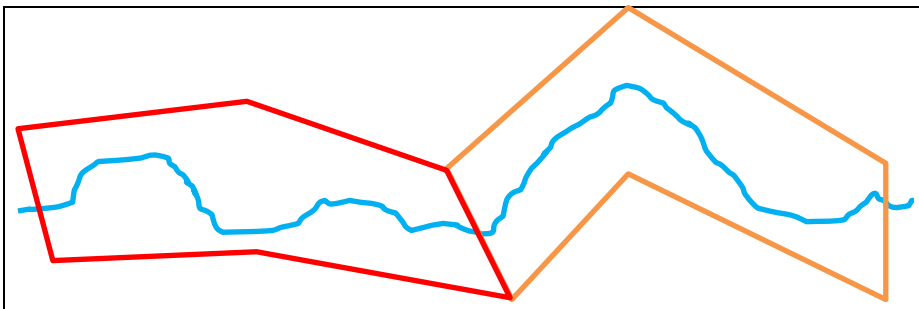

Figure 7. Diagram showing six-point river FLW polygons.

7.a.2. Entering the River FLW Polygon Vertices into HydroBase

Once the river FLW polygon vertices are determined, enter them into HydroBase, `Description` window. To access this window, from the HydroBase main menu select `RiverGage – Description`. The river FLW polygon vertices will be added to the `Affected Area` section of the `Description` window. The `Affected Area` section is near the bottom of the `Description` window (as shown in Figure 8).

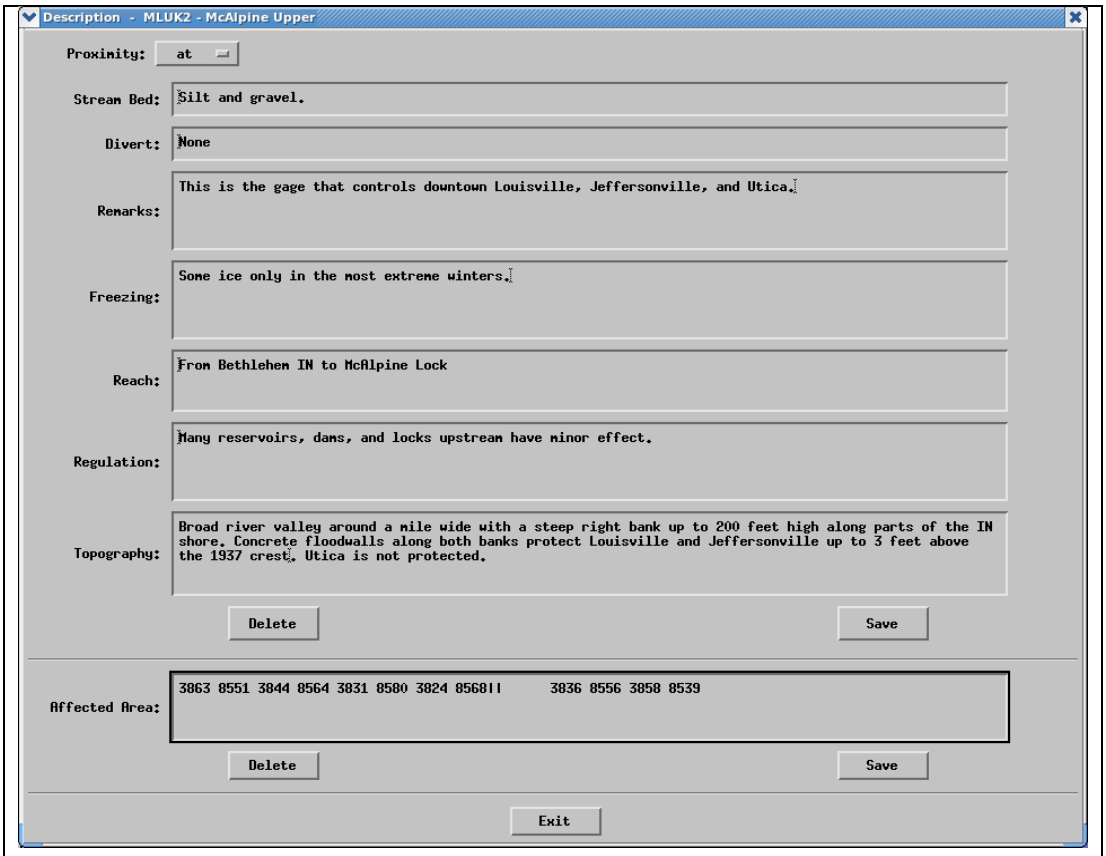

Figure 8. HydroBase `RiverGage - Description` window. Note the location of the `Affected Area` section as well as the format of the river FLW polygon vertices entry.

The character length limit for `Affected Area` is 80 characters. Also a word wrap will occur at 72 even if you have a hard return in the middle of the string. This limits the river FLW polygons to only six vertices and is why the `LAT...LON` part is not included here. To enter the river FLW polygon definition type in the first four vertices, encode a hard return (`||`), indent six spaces and then type in the last two vertices (if applicable) (as shown in Figure 8).

Figure 9 shows what the sample river FLW polygon will look like when added to a river FLW/FLS:

```
LAT...LON 3863 8551 3844 8564 3832 8580 3824 8568
      3836 8555 3859 8539
```

Figure 9. Sample river FLW polygon definition in a river FLW/FLS.

Click on the `Save` button located below the `Affected Area` section (i.e., *not* the one located below the `Topography` section). Then click on the `Exit` button at the bottom of the

Description window to return to the HydroBase main window. Repeat the entry of river FLW polygon vertices into HydroBase for every river forecast point which has a river FLW polygon defined.

7.b. RiverPro File and Configuration Changes

7.b.1. Changes to the RiverPro Tabular Template File

If you currently do not have a tabular section for your river FLWs/FLSs then you will need to create a new section for it in your office's tabular template file named tabular.tpl.XXX (where XXX is the AWIPS site identifier for your office). You can add this new section through RiverPro. To do so go to the RiverPro main men and select Settings – Modify Product Sections – Tabular – Edit Template File. Figure 10 shows the tabular template file in an AWIPS text editor.

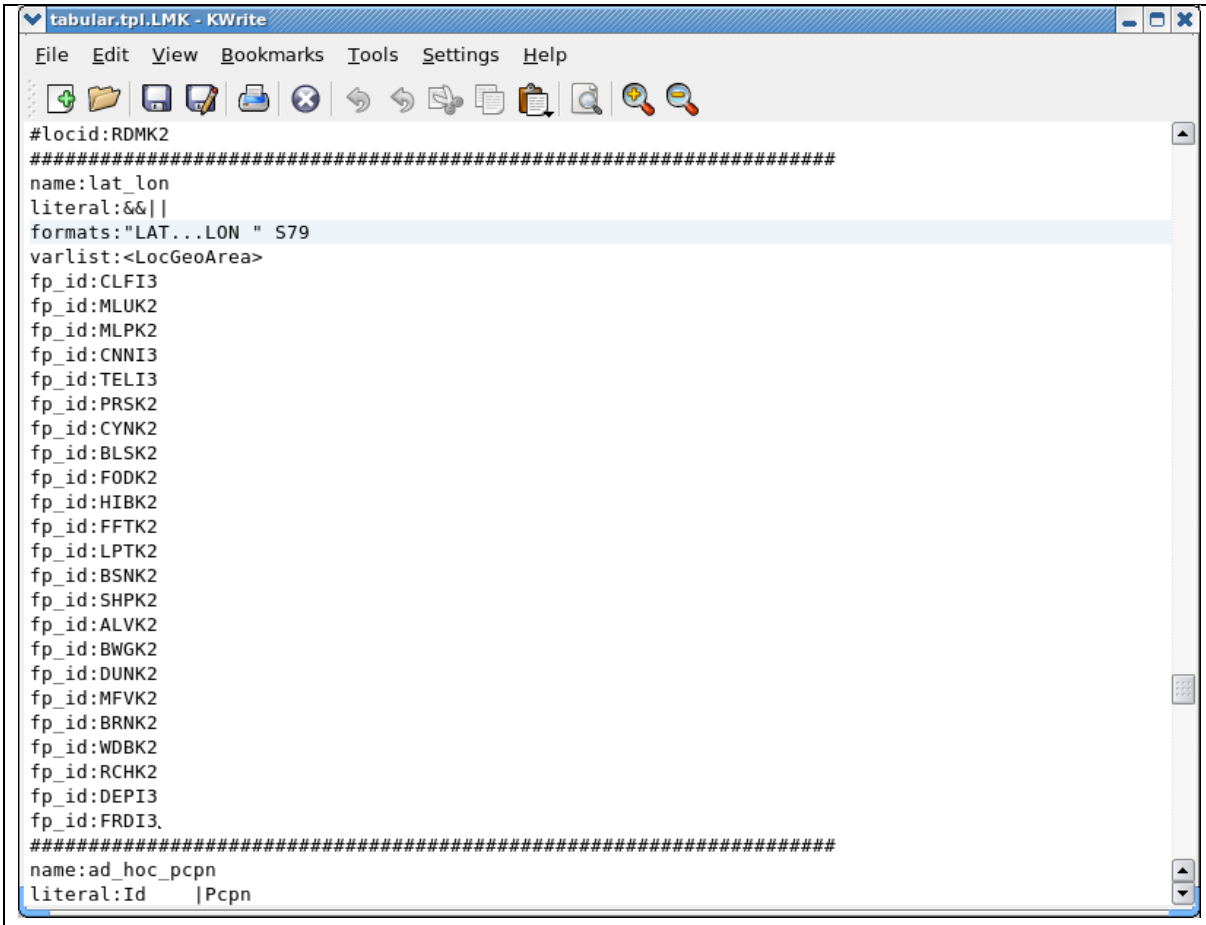

Figure 10. The lat_lon section of the tabular.tpl.XXX file (where XXX is the AWIPS site identifier for your office) as displayed in an AWIPS text editor.

Note the space after LAT...LON and the S79 format. For some reason S80 did not work.

If you are adding a new section to your `tabular.tpl.XXX` then inclusion of the `fp_id` lines are optional but are a best practice. If you do not yet have river FLW polygons defined for all of your river forecast points then you can include the `fp_id` lines for only the river forecast points which the river FLW polygons are defined. You must then add the `fp_id` lines later for those river forecast points when the river FLW polygon vertices become available.

If you already have a section within your `tabular.tpl.XXX` file such as `fls_and_flw` (i.e., which creates a table of river forecast information) and wish to add the latitude/longitude information at the end of this named section (i.e., `fls_and_flw`) then you will add the lines (as shown in Figure 10) but skip the `name:` line and instead add the text in Figure 10 to the bottom of the existing section. In this case the `fp_id` lines are NOT optional. In other words you must include the same number of `fp_id` lines as number of river forecast points in your office's HSA. You will also need to add these same `fp_id` lines immediately following the `<varlist>` statement for existing forecast information and the other immediately following the `<varlist>` statement for the new river FLW polygon section. Both lists must be identical—both in content and in order—as shown in Figure 11.

```
name:fls_and_flw
grpname:skip
formats:"&&"
miscwrt:
literal:
literal:                 FLD  OBSERVED           FORECAST 6AM
formats:"LOCATION      STG " " STG  DAY TIME" X4 T_AW X4 T_AW X4 T_AW
varlist:<Day1> <Day2> <Day3>
miscwrt:
formats:X2 S12 X2 F2.0 X2 F4.1 X1 T_AWHH X2 F5.1 X2 F5.1 X2 F5.1
varlist:<IdName> <FldStg> <ObsStg> <ObsTime> <SpecFcstStg>
<SpecFcstStg> &
<SpecFcstStg>
specstagetime:TODAY 12:00  +1 +0 4 +2  +0 4 +3 +0 4
fp_id:XXXXX
fp_id:YYYYY
literal:
formats:"&&"
miscwrt:
literal:
#
formats:"LAT...LON" X1 S79
varlist:<LocGeoArea>
fp_id:XXXXX
fp_id:YYYYY
literal:
```

Figure 11. `fls_and_flw` section which includes both a river forecast table and river FLW polygon definition. Note the repeated inclusion of the `fp_id` lines.

If you wish to add the latitude/longitude information to the end of your product WITHOUT including the `fls_and_flw` section then add the text in Figure 12 at the end of your `tabular.tpl.XXX` file. In this case the `fp_id` lines are optional. As a best practice you should include them all however. The `lat_lon` template within your `tabular.tpl.XXX` file would look like it does in Figure 12.

```
name:lat_lon
literal||&&||
formats:"LAT...LON" X1 S79
varlist:<LocGeoArea>
fp_id:XXXXX
fp_id:YYYYY
literal:
```

Figure 12. `lat_lon` section to use in lieu of the `fls_and_flw` section.

7.b.2. Change Settings for RiverPro Flood Products

Next you must change the settings files for flood products. These settings files can be modified via the `Product Generation Settings` window in RiverPro. To access this window, from the RiverPro main window select the product to be changed in the products list (i.e., on the left hand side of the RiverPro menu). Then from the RiverPro main menu select `Settings – Modify product sections`. Figure 13 shows the resulting `Product Generation Settings` window for this purpose.

For each flood product to which you wish to add the river FLW polygon definitions, do the following:

1. Make sure the `Tabular` section follows after the `Forecast Point Subsections` order. (In Figure 13, the specified order of `Forecast Point Subsections` is 4th. Thus `Tabular` is 5th.)
2. Make sure the `lat_lon` section is the specified section to use for `Tabular`. To specify it, click on the `Tabular` button (as shown in Figure 13). In the resulting `Tabular Section Settings` window (as shown in Figure 14) choose the `lat_lon` section you are using by highlighting it in the list. Then click the `Apply` button to return to the `Product Generation Settings` window.
3. Make sure that the `Within Segment` option is selected (as shown in Figure 13).
4. Click on the `Apply` button (as shown in Figure 13) to make this change. Then click on the `Close` button to return to the RiverPro main window.
5. In the RiverPro main menu select `Settings – Save to Settings File` which will update the PCC file (as shown in Figure 15).
6. Leave the box empty next to the option `Save Instructions for Including Specific Forecast Points:` (as shown in Figure 15).
7. Once you are sure that everything is in working order make the change permanent. Click

the OK button (as shown in Figure 15). You will then return to the RiverPro main window.

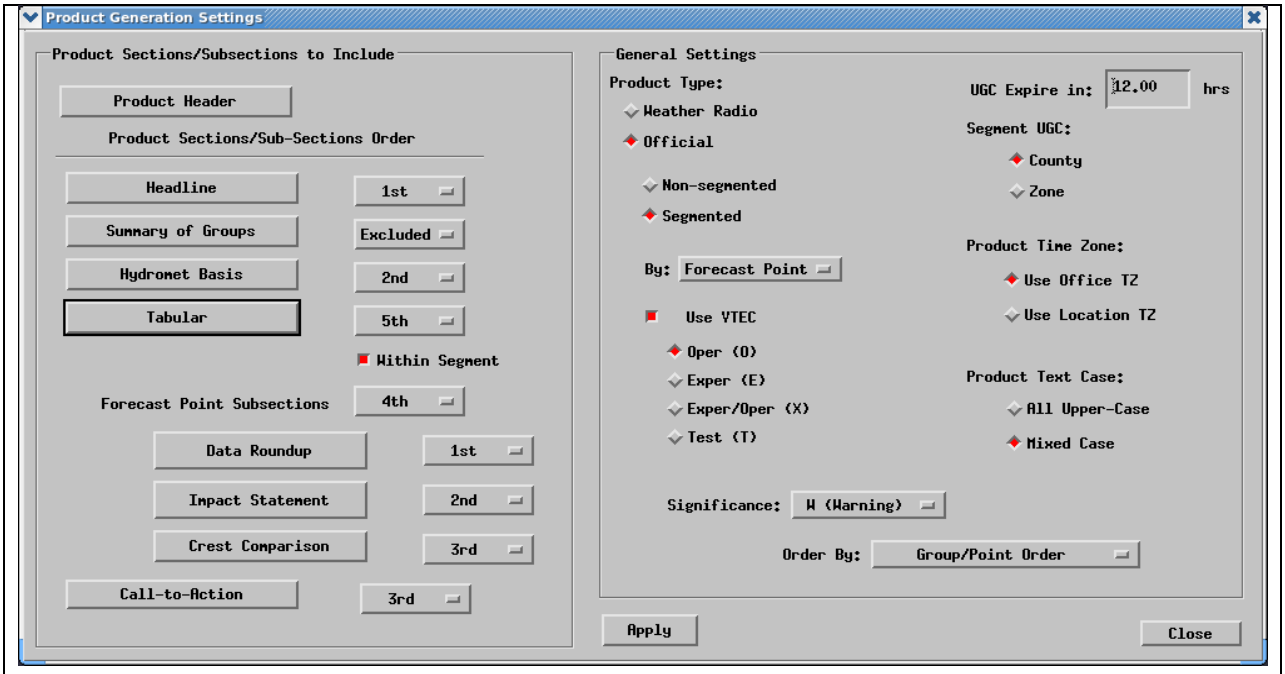

Figure 13. The `Product Generation Settings` window in RiverPro (associated with the tabular template file).

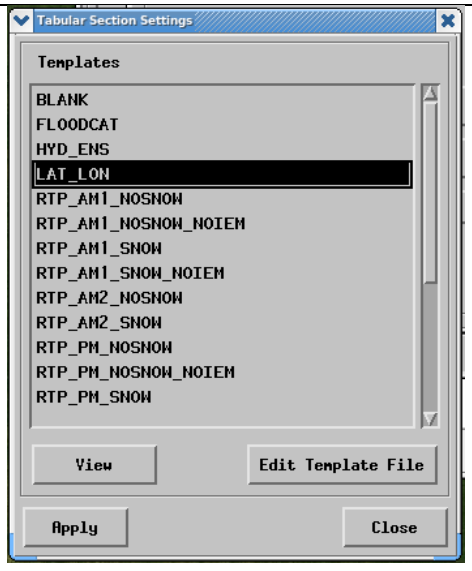

Figure 14. The `Tabular Section Settings` window in RiverPro.

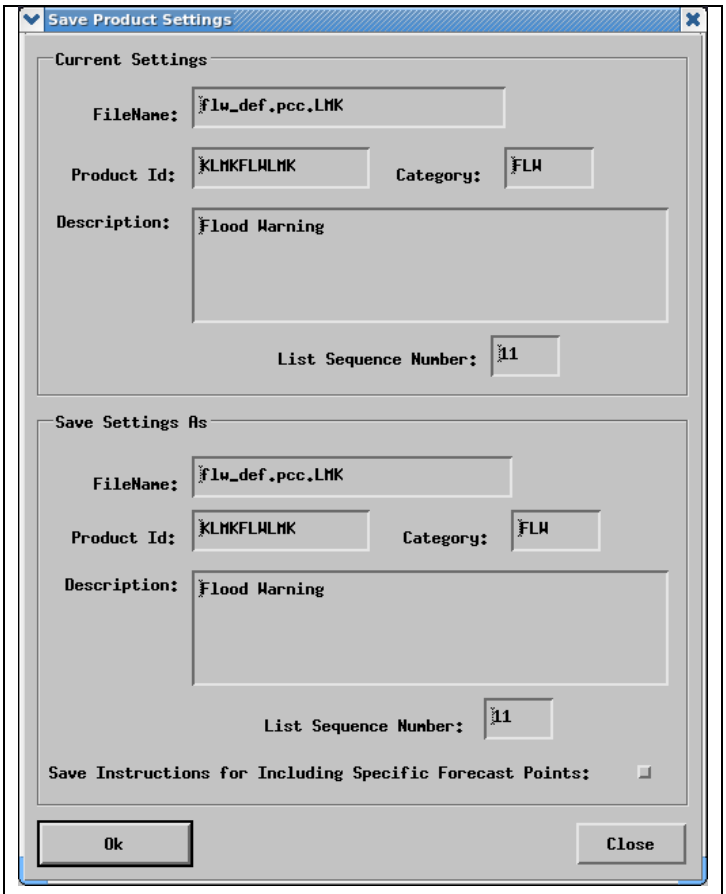

Figure 15. The `Save Product Settings` window in RiverPro (associated with the tabular template file).

8. How this Alternative Method Works

The text you provided in HydroBase for `Affected Area` (e.g., Figure 8) is stored in the `area` field of the `locarea` Postgres table of the local IHFS database. The `<LocGeoArea>` variable in RiverPro inserts everything that is stored in the area field of the `locarea` table. The result is a blank line followed by a double ampersand (i.e., `&&`) and then followed by two blank lines (i.e., created by the double pipe `||`) and then followed by the phrase `LAT...LON` and your defined latitude/longitude pairs.

If you do not yet have a river FLW polygon defined for a given river forecast point then you can leave the section next to `Affected Area` blank. Due to how this alternative method works RiverPro would then print the `LAT...LON` phrase but then output no latitude/longitude information for that particular river forecast point.

9. Advantages and Disadvantages of Each Method

The methods described in this document have their own pros and cons. Table 1 summarizes them for each method.

Note #1: the advantages and disadvantages are from the perspective of each method—not the merits of the river FLW polygons themselves.

Note #2: each method may have several its own nuances. Table 1 summarizes the most significant advantages and disadvantages. It does not necessarily include all of the pros and cons of each method.

Method	Advantages	Disadvantages
WFO Des Moines.	Leverages MS Excel and Postgres to import river FLW polygon definitions for many river forecast points simultaneously. Advantageous to use this method if the river FLW polygon vertices are already defined in a format such as MS Excel or a text file.	Requires use of Postgres. Significant, irreparable damage may occur to the WHFS hydro database if the instructions are not followed properly. Requires that the crest comparison template is not being used. Polygon vertices may not be included for a given river forecast point due to a combination of settings involving historical crest stage windows and the range of observed historical crests in the hydro database.
Alternative Method—Section 7.	Allows river FLW polygons with up to 6 vertices. Interaction only with RiverPro template files and HydroBase is required. Allows implementation of river FLW polygon capability before all river FLW polygons are defined. Allows RiverPro to use river FLW polygon definitions that you already have.	If the `lat_lon` section within your `tabular.tpl.XXX` file is located within an existing `fls_and_flw` named section then you must explicitly state the river forecast points using a separate `fp_id:` line for each point in the flood tabular template. If the `lat_lon` section is stand-alone then this requirement is not necessary.

Table 1. Advantages and disadvantages for each method described in this document.

10. Migrating from the WFO Des Moines Method to the Alternative Method

Some offices may have already implemented the river FLW polygons using the original (i.e., WFO Des Moines) method before the alternative (i.e., WFO Dodge City and WFO Louisville) method was identified. Now, some of those same offices may want to migrate their river FLW polygon implementation from the WFO Des Moines method to the alternative method. This

section explains how to make the migration.

Note: the instructions in this section assume that you have already successfully implemented the river FLW polygons using the WFO Des Moines method.

10.a.1. Reformat the River FLW Polygon Definitions using HydroBase

In the WFO Des Moines method, each river FLW polygon is defined in the `Affected Area` section of the HydroBase `RiverGage – Description` window as a string of numbers representing the vertices of the polygon. See Figure 16 for an example. In the alternative method, the format of each existing river FLW polygon definition must be changed to include a hard return (`||`) after the first four vertices, indentation of six spaces and then the last two vertices (if applicable). See Figure 17 for an example. Thus, for each river forecast point for which a river FLW polygon is already defined, follow the instructions in Section 7.a.2. Once you have completed those steps return to this section and continue.

```
3863 8551 3844 8564 3831 8580 3824 8568 3836 8556
```

Figure 16. Example river FLW polygon definition in the `Affected Area` section of the HydroBase `RiverGage – Description` window, using the WFO Des Moines method.

```
3863 8551 3844 8564 3831 8580 3824 8568||      3836 8556
```

Figure 17. Example river FLW polygon definition in the `Affected Area` section of the HydroBase `RiverGage – Description` window, using the alternative method. Note the inclusion of a hard return (`||`) plus the following six spaces.

10.a.2. Modify the RiverPro Tabular Template File

Your RiverPro `tabular.tpl.XXX` file (where `XXX` is the AWIPS site identifier for your office) must be modified to include the river FLW polygon definitions. Follow the instructions in Section 7.b.1. Once you have completed those steps return to this section and continue.

10.a.3. Modify RiverPro to Not Use the Crest Comparison Template File for the River FLW Polygons

In the WFO Des Moines method, RiverPro used the crest comparison template file to include the river FLW polygon definitions in its text products. Now you must instruct RiverPro to not use the crest comparison template for this purpose. Thus you must change the settings files for each flood product accordingly. These settings files can be modified via the `Product Generation Settings` window in RiverPro. To access this window, from the RiverPro main window select the product to be changed in the products list (i.e., on the left hand side of the RiverPro menu). Then from the RiverPro main menu select `Settings – Modify product sections`. Figure 18 shows the resulting `Product Generation Settings` window for this purpose.

For each flood product to which you wish discontinue use of the crest comparison template in showing the river FLW polygon definitions, do the following:

1. Exclude use of the `Crest Comparison` subsection. Change the `Order` setting for `Crest Comparison` to `Excluded` (as shown in Figure 18).
2. (Optional) Change the section used for `Crest Comparison`. To change it, click on the `Crest Comparison` button (as shown in Figure 18). In the resulting `Crest Comparison Sub-Section Section Settings` window (as shown in Figure 19) choose a template in the Templates section (i.e., upper right hand portion of the window) to something other than `lat_lon`. (In Figure 19, `DEFAULT` was selected.) Click the `Apply` button then click the `OK` button to return to the `Product Generation Settings` window.
3. Click on the `Apply` button (as shown in Figure 18) to make this change. Then click on the `Close` button to return to the RiverPro main window.
4. In the RiverPro main menu select `Settings – Save to Settings File` which will update the PCC file (as shown in Figure 20).
5. Leave the box empty next to the option `Save Instructions for Including Specific Forecast Points:` (as shown in Figure 20).
6. Once you are sure that everything is in working order make the change permanent. Click the `OK` button (as shown in Figure 20). You will then return to the RiverPro main window.

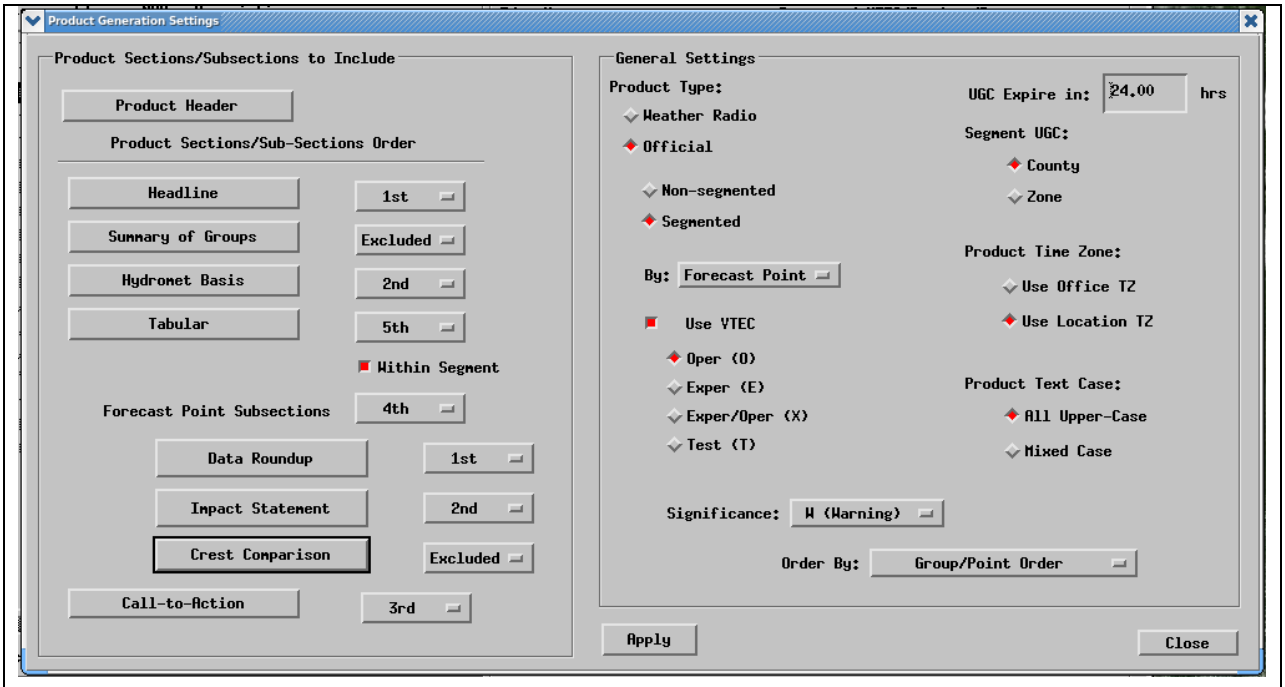

Figure 18. The `Product Generation Settings` window in RiverPro (associated with the crest comparison template file).

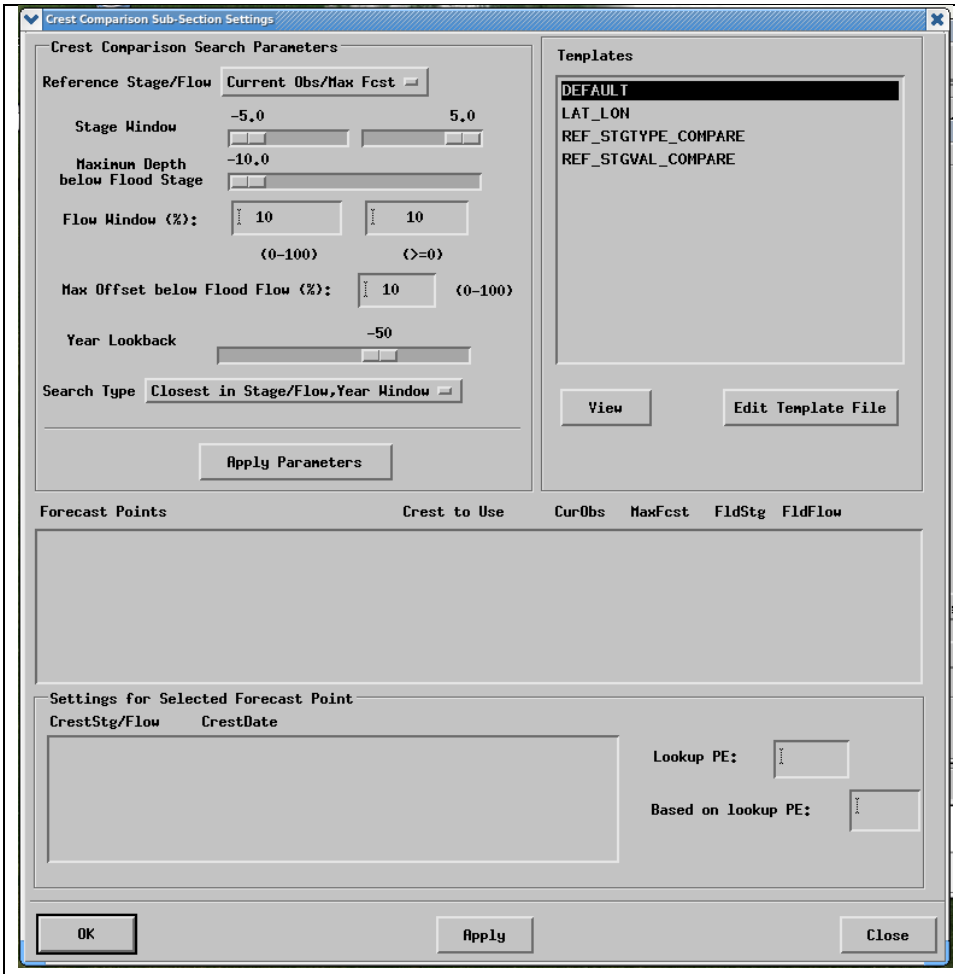

Figure 19. The `Crest Comparison Sub-Section Settings` window in RiverPro.

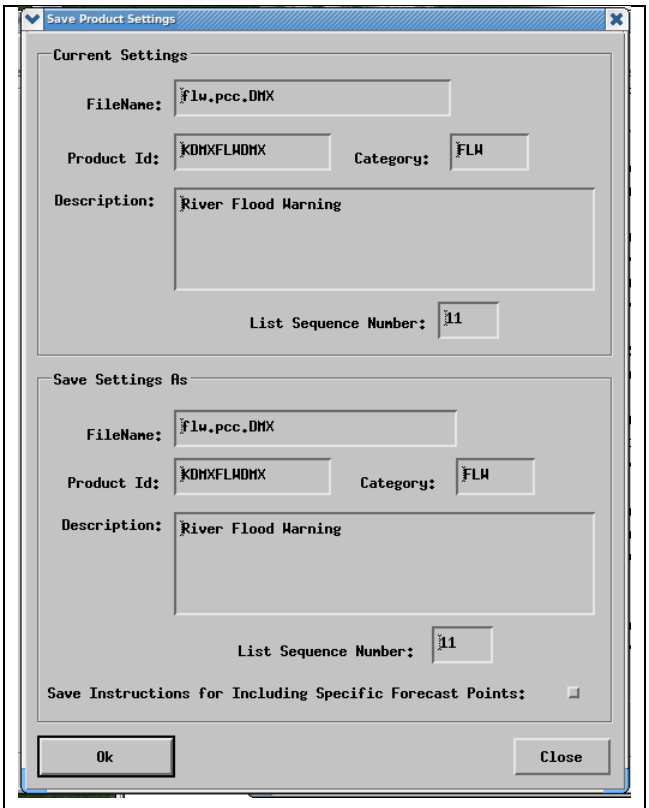

Figure 20. The `Save Product Settings` window in RiverPro (associated with the crest comparison template file).

10.a.4. Modify RiverPro to Use the Tabular Template File for the River FLW Polygons

You must next modify the RiverPro settings to use the tabular template file to include the river FLW polygon definitions. Follow the instructions in Section 7.b.2. Remember to follow those instructions for each flood product you wish to change.

Once you have completed the above steps you have completed the migration from the WFO Des Moines method to the alternative method.

11. Finished Product

Figure 21 is an example of a river FLS which includes the river FLW polygon delineations. The river FLW polygon delineations are highlighted.

```
WGUS83 KSGF 201547
FLSSGF

FLOOD STATEMENT
NATIONAL WEATHER SERVICE SPRINGFIELD MO
947 AM CST TUE DEC 20 2011

...THE FLOOD WARNING CONTINUES FOR THE FOLLOWING RIVERS IN
MISSOURI...

  LITTLE OSAGE NEAR HORTON AFFECTING VERNON COUNTY
  MARMATON RIVER NEAR NEVADA AFFECTING VERNON COUNTY

.HEAVY RAINFALL WHICH OCCURRED OVER THE LITTLE OSAGE AND MARMATON
RIVER BASINS YESTERDAY HAS CAUSED RIVER LEVELS TO RISE.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

DO NOT DRIVE THROUGH FLOWING WATER.  NEARLY HALF OF ALL FLOOD
FATALITIES ARE VEHICLE RELATED.  AS LITTLE AS 6 INCHES OF WATER MAY
CAUSE YOU TO LOSE CONTROL OF YOUR VEHICLE.  TWO FEET OF WATER WILL
CARRY MOST VEHICLES AWAY.

STAY TUNED TO NOAA WEATHER RADIO FOR LATER STATEMENTS.

ADDITIONAL RIVER INFORMATION CAN BE FOUND ON OUR ADVANCED HYDROLOGIC
PREDICTION SERVICE PAGE AT
HTTP://WWW.CRH.NOAA.GOV/AHPS2/INDEX.PHP?WFO=SGF (ALL LOWER CASE)

&&

MOC217-210647-
/O.EXT.KSGF.FL.W.0045.111221T0000Z-111223T0800Z/
/HTNM7.1.ER.111221T0000Z.111221T1800Z.111222T0800Z.NO/
947 AM CST TUE DEC 20 2011

THE FLOOD WARNING CONTINUES FOR
  THE LITTLE OSAGE NEAR HORTON.
* AT  8:45 AM TUESDAY THE STAGE WAS 40.0 FEET.
* FLOOD STAGE IS 41.0 FEET.
* MINOR FLOODING IS FORECAST.
* FORECAST...RISE ABOVE FLOOD STAGE BY THIS EVENING AND CONTINUE
  TO RISE TO NEAR 41.6 FEET BY TOMORROW EVENING. THE RIVER WILL
  FALL BELOW FLOOD STAGE BY EARLY THURSDAY MORNING.
* IMPACT...AT 41.0 FEET...MINOR FLOODING AFFECTS LOW LYING AREAS
  NEAR THE GAGE SITE AND FARMLAND ALONG THE RIVER.

&&

LAT...LON 3800 9454 3801 9437 3795 9437 3794 9455
```

```
$$

MOC217-210647-
/O.CON.KSGF.FL.W.0046.111221T0900Z-111223T0000Z/
/NVDM7.1.ER.111221T0900Z.111221T1200Z.111222T0000Z.NO/
947 AM CST TUE DEC 20 2011

THE FLOOD WARNING CONTINUES FOR
  THE MARMATON RIVER NEAR NEVADA.
* AT  8:45 AM TUESDAY THE STAGE WAS 14.3 FEET.
* FLOOD STAGE IS 20.0 FEET.
* MINOR FLOODING IS FORECAST.
* FORECAST...RISE ABOVE FLOOD STAGE BY EARLY TOMORROW AND
  CONTINUE TO RISE TO NEAR 20.2 FEET BY TOMORROW EARLY
  AFTERNOON. THE RIVER WILL FALL BELOW FLOOD STAGE BY TOMORROW
  EVENING.
* IMPACT...AT 20.0 FEET...MINOR FLOODING OCCURS NEAR THE GAGE
  SITE AND AFFECTS LOW LYING AREAS ALONG THE RIVER.

&&

LAT...LON 3785 9454 3784 9441 3791 9435 3793 9438

$$

END
```

Figure 21. Example of a river FLS with river FLW polygon definitions included.

12. Final Notes

If in the future, WFO hydrologic services are modified to add a new river forecast point or remove an existing river forecast point then the following items must be done:

- Define the river FLW polygon vertices for a new river forecast point. If WFO hydrologic services are being changed to remove a river forecast point then the river FLW polygon vertices do not need to be deleted for that location.
- Add or remove that particular forecast point in the `lat_lon` section in your `tabular.tpl.XXX` file.

13. For More Information

For more information or questions on this particular procedure contact Jeff Zogg at WFO Des

Moines, Iowa, Rick Sloan at WFO Dodge City, Kansas or Mike Callahan at WFO Louisville, Kentucky. Contact information is in Table 2.

Office	Contact Information
WFO Des Moines, Iowa	Jeff Zogg, Senior Service Hydrologist E-mail: jeff.zogg@noaa.gov Phone: 515-270-4501 x493
WFO Dodge City, Kansas	Rick Sloan, Service Hydrologist E-mail: richard.sloan@noaa.gov Phone: 620-225-6514 x493
WFO Louisville, Kentucky	Mike Callahan, Senior Service Hydrologist E-mail: mike.callahan@noaa.gov Phone: 502-969-8842 x493

Table 2. Contact information for more additional information or questions.

For general WHFS/Postgres questions contact the WHFS Support Group. Their Web site is https://ocwws.weather.gov/intranet/whfs/ .

(End)